

Refractive Index

Refractive Index is an optical characteristic of a substance and the dissolved particles in it.

The refractive index of a substance is strongly influenced by temperature and the wavelength of light used to measure it. Therefore, care must be taken to control or compensate for temperature differences and wavelength. The refractive index measurements are usually reported at a reference temperature of 20°C (68°F), which is considered to be room temperature.

Refractive index is defined as the ratio of the speed of light in a vacuum to the speed of light in a substance. A result of this property is that light will "bend," or change direction, when it travels through a substance with a different refractive index. This is called refraction.

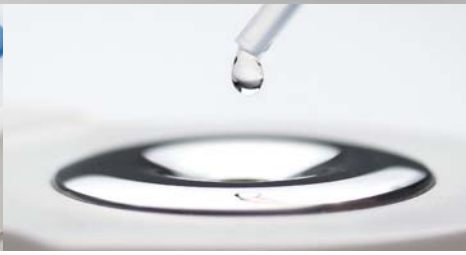
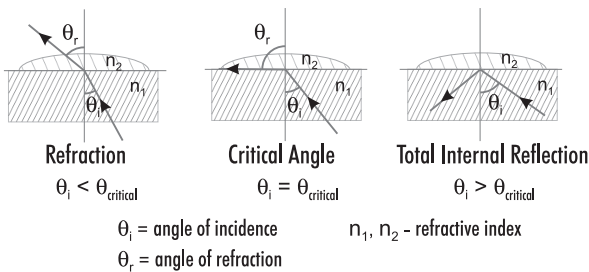
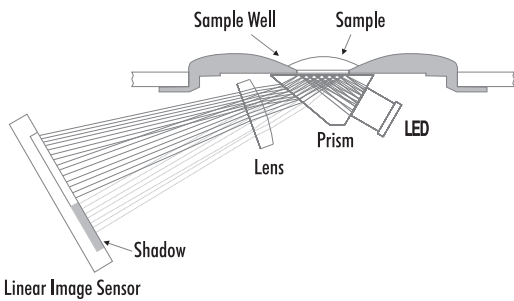
When passing from a material with a higher to lower refractive index, there is a critical angle at which an incoming beam of light can no longer refract, but will instead be reflected off the interface between the two substances. This is called total internal reflection.

The critical angle can be used to easily calculate the refractive index according to the equation:

$$\sin(\theta_{critical}) = n_2 / n_1$$

Where n_2 is the refractive index of the lower-density medium; n_1 is the refractive index of the higher-density medium.

A digital refractometer uses an LED to pass light through a prism in contact with the sample. An image sensor determines the critical angle at which the light is no longer refracted through the sample. Specialized algorithms then apply temperature compensation to the measurement and convert the refractive index to the specified parameter.



Hanna Digital Refractometers

- **Automatic Temperature Compensation**
 - For exceptionally accurate measurements
- **Easy measurement**
 - Place a few drops of the sample in the well and press the READ key
- **BEPS**
 - (Battery Error Prevention System) alerts the user in the event that low battery power could adversely affect readings
- **IP65 water protection**
 - Built to perform under harsh laboratory and field conditions
- **Single-point calibration**
 - Calibrate with distilled or deionized water
- **Small sample size**
 - Sample size can be as small as 2 metric drops
- **Stainless steel sample well**
 - Easy to clean and corrosion-resistant
- **ABS thermoplastic casing**
- **Startup**
 - When powered on, the meter displays battery life and the set measurement units
- **Unit selection**
 - Pressing the RANGE key quickly cycles through the units of measurement (if applicable)



HI96800 • HI96801 • HI96802
HI96803 • HI96804

Digital Refractometers

for Sugar Analysis Throughout the Food Industry

- **Ideal for the analysis of:**
 - Fruits, energy drinks, puddings, soy milk, juices, jam, marmalade, honey, soups, jelly, tofu and condiments
- **Dual-level LCD**
 - The dual-level LCD displays measurement and temperature readings simultaneously
- **ATC**
 - Automatic Temperature Compensation
- **Easy measurement**
 - Place a few drops of the sample in the well and press the READ key
- **BEPS**
 - Alerts the user of low battery power that could adversely affect readings
- **IP65 water protection**
 - Built to perform under harsh laboratory and field conditions
- **Quick, accurate results**
 - Readings are displayed in approximately 1.5 seconds
- **One-point calibration**
 - Calibrate with distilled or deionized water
- **Small sample size**
 - Sample size can be as small as 2 metric drops
- **Automatic shut-off**
 - After three minutes of non-use
- **Stainless steel sample well**
 - Easy to clean and corrosion-resistant
- **ABS thermoplastic casing**



Five Instruments for Sugar Analysis

Hanna offers five sugar refractometers to meet the requirements of the food industry. The HI96800 Refractive Index/Brix, HI96801 % Brix (sucrose), HI96802 Fructose, HI96803 Glucose and HI96804 Invert Sugar digital refractometers are rugged, portable and water-resistant for measurements in the lab or field.

These optical instruments employ the measurement of the refractive index to determine parameters pertinent to sugar concentration analysis.

Refractive Index

The actual measurement of refractive index is simple, quick and provides the operator a standard accepted method for sugar content analysis. Samples are measured after a simple user calibration with deionized or distilled water. Within seconds these instruments measure the refractive index, apply any necessary calculations and display the results in the selected unit. These digital refractometers eliminate the uncertainty associated with mechanical refractometers and are easily portable for measurements in the field.

Features

These five instruments utilize internationally recognized references for unit conversion and temperature compensation and employ methodology recommended in the ICUMSA Methods Book (internationally recognized body for sugar analysis).

Temperature (in °C or °F) is displayed simultaneously with the measurement on the large dual-level display along with icons for low power and other helpful messages.

5 Digital Refractometers for Sugar Analysis to Choose from

HI96800

Measures the refractive index in aqueous solutions. Readings can also be displayed with sucrose temperature compensation ($n_{D_{20}}$) or % Brix.

- 1.3300 to 1.5080 Refractive Index range with ± 0.0005 accuracy
- 0 to 85% Brix range with $\pm 0.2\%$ accuracy

HI96801

Measures the refractive index to determine the % Brix of sugar in aqueous solutions. The refractive index of the sample is converted to % Brix concentration units.

- Temperature Compensation algorithms based on sucrose solution
- 0 to 85% Brix range with an accuracy of $\pm 0.2\%$

HI96802

Measures the refractive index to determine the % fructose in aqueous solutions. The refractive index of the sample is converted to % mass (% w/w) concentration units.

- Temperature Compensation algorithms based on fructose solution
- 0 to 85% fructose by weight range with an accuracy of $\pm 0.2\%$

HI96803

Measures the refractive index to determine the % glucose in aqueous solutions. The refractive index of the sample is converted to % mass (% w/w) concentration units.

- Temperature Compensation algorithms based on glucose solution
- 0 to 85% glucose by weight range with an accuracy of $\pm 0.2\%$

HI96804

Measures the refractive index to determine the % invert sugar in aqueous solutions. The refractive index of the sample is converted to % mass (% w/w) concentration units.

- Temperature Compensation algorithms based on invert sugar solution
- 0 to 85% invert sugar by weight range with an accuracy of $\pm 0.2\%$

Making a Standard % Brix Solution

To make a Brix Solution, follow the procedure below:

- Place container (such as a glass vial or dropper bottle that has a cover) on an analytical balance.
- Tare the balance.
- To make an X % Brix solution, weigh out X grams of high purity sucrose (CAS #: 57-50-1) directly into the container.

- Add distilled or deionized water to the container so the total weight of the solution is 100 g.

Note: Solutions above 60% Brix need to be vigorously stirred or shaken and heated in a water bath. Remove solution from bath when sucrose has dissolved. The total quantity can be scaled proportionally for smaller containers but accuracy may be sacrificed.

Example with 25% Brix:

% Brix	25
g Sucrose	25.000
g Water	75.000
g Total	100.000

Specifications	HI96800	HI96801	HI96802	HI96803	HI96804	
Sugar Content	Range	1.3300 to 1.5080 nD; 1.3330 to 1.5040 $n_{D_{20}}$; 0.0 to 85.0% Brix	0 to 85% Brix	0 to 85% mass (% w/w fructose)	0 to 85% mass (% w/w glucose)	0 to 85% mass (% w/w invert sugar)
	Resolution	0.0001 nD; 0.0001 $n_{D_{20}}$; 0.1 % Brix	0.1 % Brix	0.1 % mass	0.1 % mass	0.1 % mass
	Accuracy (@25°C/77°F)	± 0.0005 nD; ± 0.0005 $n_{D_{20}}$; $\pm 0.2\%$ Brix	$\pm 0.2\%$ Brix	$\pm 0.2\%$ mass	$\pm 0.2\%$ mass	$\pm 0.2\%$ mass
Temperature	Range	0.0 to 80.0°C (32.0 to 176.0°F)				
	Resolution	0.1°C (0.1°F)				
	Accuracy (@25°C/77°F)	$\pm 0.3^\circ\text{C}$ ($\pm 0.5^\circ\text{F}$)				
Additional Specifications	Temperature Compensation	automatic between 10 and 40°C (50 to 104°F)				
	Measurement Time	approximately 1.5 seconds				
	Minimum Sample Volume	100 μL (to cover prism totally)				
	Light Source	yellow LED				
	Sample Cell	stainless steel ring and flint glass prism				
	Auto-off	after three minutes of non-use				
	Enclosure Rating	IP65				
	Battery Type / Battery Life	9V / approximately 5000 readings				
Dimensions / Weight	192 x 102 x 67 mm (7.6 x 4.01 x 2.6") / 420 g (14.8 oz.)					
Ordering Information	HI96800, HI96801, HI96802, HI96803 and HI96804 are supplied with battery and instruction manual.					